The question of water supply has acquired sudden prominence in the world's news media over the past year-and-a-half, thanks mainly to two major international conferences. But the problem is by no means new, nor is the solution as simple as slogans like "Water for All" might suggest.

On the following pages, an examination of the water supply situation and its relationship to health, economic, social, technological and other factors.

What do bullock carts have in common with water pumps? More than you might think . . . . read on.

Water supply needs an integrated approach

Michael G. McGarry

At the United Nations Conference on Water held in Argentina last March, a great deal was said about water supplies and the need — if not human right — for safe reliable water within reasonable access to all. The UN Water Conference was preceeded by Habitat out of which came the recommendation for clean water for all by 1990.

The justification for setting a target requiring $30 billion per year over the next 14 years hinges largely on health, the prevalence of enteric infections and other water-related diseases in developing countries, and the ability of improved accessibility of safe water supplies to combat these diseases. In the eyes of the so-called "developed society", clean water is seen as a prerequisite for comfortable healthy living. This is feasible because acquiring water takes up only a very small percentage of the American or European income, and the thought of a cholera or typhoid epidemic running through New York or London via the water supplies is truly horrific.

There is a serious danger that we the "international water engineers" will transfer such concepts and practices to developing regions where such diseases as cholera and typhoid are commonplace, indeed endemic; where their normal transmission routes have little to do with the water supply, and where the people simply cannot afford to pay for water supplies. These regions tend to accept external help, and with it externally determined development priorities that may have little or nothing to do with their real needs.

On the other hand, there are areas which are in dire need of improved water supplies, where during the dry season the woman must spend a good portion of the day walking as much as 10 kilometers to scrape water from a muddy hole. These water-scarce areas justifiably demand first attention but this justification is based on labour and time-savings, not on health.

There is too great a temptation for the politician, the UN delegate, the aid agency employee, the international consultant and water engineer to simplify and generalize the solution using water as a panacea, and climb on the next international bandwagon with such catchy phrases as "Clean Water for All"! It's just not that simple. If limited finance and even scarcer human resources are to be effectively spent on improving health, we must recognize that water delivery is only one element in a complex matrix of activities which must go on if it is to have any significant effect on health at all.

The idea of clean water, plentifully available in an otherwise destitute rural village is highly attractive to the politician. It also appeals to the international bank, UN agencies and aid organizations who are now searching for ways to direct their efforts towards rural development. As a result, rural water has risen from a point of relative obscurity and shoestring budgets to a pinnacle of international publicity — with the likely result that large sums of money will be channelled into programs that are ill-equipped to cope with them.

Despite their good intentions, international aid organizations are seriously constrained by their lack of real contact with rural peoples of the developing countries; their very nature has kept them confined to a "top down" approach and separated from the very peoples they now wish to assist. They are in the main limited to participating through financial and technical assistance and are thus highly technology oriented.

The result of all this will likely be the release of large sums of aid funds to

DOSSIER: WATER & SANITATION

Better planning is the key

Bob Stanley

Advocates of rural water supply programs often base their arguments on the potential improvements to health, agriculture and the local economy that a clean water supply will bring. A recent study in Lesotho, however, has shown that the country's water supply program has brought none of these benefits.

Says Dr Richard Feachem, a public health engineer who spent two years in southern Africa evaluating water supply programs: "Our studies in Lesotho demonstrated no measurable economic benefits from the rural water supply program at all. No benefits to health. No benefits to productive agriculture or other activities." In fact, he adds, the only measurable benefit was the considerable savings of women's time, since they no longer had to spend hours each day carrying water.

This is an important social benefit, says Dr Feachem, and the lack of other benefits in no way implies that improved water supply is not worth building. "It demonstrates, however, that water supply in isolation does not provide any other benefits."

What is needed, says Feachem, is better planning. It is necessary to educate the people in matters of hygiene and proper use of water. The Lesotho study, for example, found that villagers with access to an improved water supply do not use any more water than others (a finding that is borne out by similar studies in East Africa). So the hygiene doesn't improve, the transmission of "water-washed" diseases doesn't change, and the net result is no improvement in health.

It is also necessary to provide training in the maintenance of the water supply system. Otherwise, says Dr Feachem, it will be only a matter of time before the water supply breaks down, the villagers go back to using their old polluted water source, and everybody's time and money will have been wasted.

The breakdown problem is often complicated by the fact that many African countries have gone for self-help and community participation in water supply, says Dr Feachem, and in doing so have passed on to the villages responsibilities that they are not set up to cope with. Governments too often have not thought out which village institutions should be responsible for what, and what it is reasonable to ask them to be responsible for.

Governments also expect that if the village helps to install the water supply it will also maintain it. This is the classic argument in favour of community development. In fact, says Dr Feachem, the reverse is often true. The villagers believe that, because they have contributed both time and labour to install the system, and paid part of the cost, then the government should maintain it, not them. "This was put to us forcefully time and time again," he adds.

Finally, says Dr Feachem, it is often simply a case of expecting too much of the people. "Villages in Africa are often asked to take on far more than a village in Europe or North America has ever been asked to do.

"Many of the things a village in Africa has been asked to do would certainly not get done if you asked a village in England to do them. We have documented precisely the same inability to carry out certain routine functions in villages in England as in Africa."

provide inducement for a more rapid expansion of rural water delivery programs in developing countries. Money in this context implies technology, and technological solutions will be sought and pressed into service to meet the construction targets set by the funds being made available. Unfortunately there is a severe shortage of experienced manpower capable of implementing effective rural water delivery programs in both the donor agencies and recipient countries alike. This, coupled with the inherent difficulty of successfully introducing any kind of technology to the rural community will likely result in gross errors and financial resources being wasted at high opportunity cost. Worse still, as experience in Africa has shown, the villager will become disillusioned and skeptical, even resistant to future efforts by his urban counterpart to improve his lot.

At the risk of over-simplification, we can broadly classify rural communities into three groups according to their accessibility to water and the approach which may be taken to improve the supply of water.

In the first group are the rural villages without adequate access to a year-round supply of any kind. These are termed the water-scarce villages where during the dry season water must be carried over a distance of several kilometers. Water is badly needed in whatever quantity and quality. Benefits to be accrued are largely in terms of labour and time savings, not health. These communities clearly view accessibility to water as being their highest priority and should be dealt with first.

The second type of community does have perennial alternative water sources within reasonable access. Given free choice, they would likely choose other development priorities than improving their existing water sources. Not surprisingly the vast majority of rural communities fall in this category. Consider the village which has for centuries collected water from a nearby stream during the wet season and when it dries up draws water from deep dug wells, also within easy access. As far as international standards are concerned, all these sources of water are heavily contaminated — but life goes on regardless. Then clean water is brought to the village; a hand-pump is installed. It is accepted and used, but the women and children collect the same amount of water as they did before and in the same containers. Daily routine doesn't change and the buckets and household containers are just as contaminated as they were before. Faecal contamination of household utensils, clothes, hands and food persists; the smaller children continue to defecate indiscriminately around the household. The nearby stream and wells are also used for water supply as they have always been as far as any one can remember.

Then one day a metal pin on the pump breaks and it falls idle. There is no perceived need to request its repair. Even if there were, who would the villagers ask, and what would be the response? No one is noticeably worse off by the pump's introduction and failure. The village is unaffected; the engineer and his administrator can chalk up yet another water supply installed — but at what cost? The price paid is in the wastage of scarce manpower and financial resources, the misconception that rural development has been enhanced and in the skepticism engendered and confirmed in the villagers perception of the government's ineffectual "assistance".

The third grouping encompasses the rural town which may or may not be water-scarce but which is large and organized enough to be directly accessible to the central government water supply implementing agency. Here the top-down approach can be taken. Piped water to the household is usually the objective, a committee or municipal department can be made directly responsible to ensure continued maintenance of the system and collect water rates to pay for maintenance and extension costs. Here health benefits are likely to accrue, water is being made plentifully available inside the home. Water-use practices will change and sanitary education is relatively easy to effect. The rural towns are and will continue to be serviced first. They are attractive to outside funds in terms of accessibility, capacity for repayment of loans, potential health benefits and ease of centrally coordinated management.

The water-scarce village will also be given priority, but there exists no capacity to maintain the tubewell or piped water system, the villages are most often over a day's journey over rough roads away from the central point of administration and supplies. Here the top-down approach is highly susceptible to failure. Examples of clogged well screens, broken hand-pumps, seized diesel engines, burst pipes, and defunct standpipe taps are commonplace throughout the country where the top-down approach is taken.

Up to this point I have been somewhat critical, even cynical in highlighting the pitfalls of implementing water and sanitation programs in rural areas. There are some success stories: in Malawi for example, village participation was the key to success in bringing piped water to over 150,000 villagers falling in the water-scarce category at a cost of less than $3 per capita. The engineer, backed by the Department of Community Development and Social Welfare, began on a small scale by physically demonstrating that one could transport water through pipes from a perennial mountain stream several kilometers away. Convinced, the villagers participated by digging all the trenches, layed the pipes and constructed the concrete aprons and soak-away pits around the village taps.

This initial demonstration mushroomed, soon the demand for piped water outstripped the capability to deliver. The "barefoot engineer" concept was introduced in the form of rural water technicians for the ever-expanding activity. Three-week technical courses are conducted for carefully selected technically oriented men with limited education. This training also includes a major community development component. Initially the piped water projects were small in size, making use of demonstrations and examples so that the villagers knew exactly what they were getting into. Now, large public meetings are held to ensure that any commitments being made are fully understood and acknowledged by all. More importantly, this approach involves the people not only in construction but in decision-making roles so that they are, to a large extent, responsible for the success of the system and willing to take on its continued maintenance and repair.

The community development approach taken in Malawi took a decade of patience, understanding and hard work to achieve. It is a clear cut example of success; unfortunately the urgency with which international funds will have to be spent, the commercial drive of equipment manufacturers and the inexperience of agencies in dealing with rural peoples are likely to result in no heed being taken.

It is the need for the bottom-up approach in rural villages that poses the greatest barrier to the national water authority's effectiveness. Such authorities are typically staffed by engineers, economists and administrators not by sociologists and community development officers. Inherently, they operate through the medium of technology and by past experience they are urban systems oriented. With few exceptions, recent experience has revealed their incapacity to reach and interact effectively with the rural village. Some other mechanism capable of operating at the village level is needed. In principle, community development departments are well suited to the task of ensuring village participation and commitment, but in many countries they are relatively ineffectual and lack the technical capability required to design and construct water and sanitation systems, nor are they health oriented.

I would like now to take up the role of primary health care programs in improving rural water supply and sanitation in rural areas. We are well aware of the shortcomings of many conventional health services of developing countries in which emphasis has been on creating sophisticated centralized medical services, the training of highly competent qualified medical personnel and an orientation towards curative medicine practices. The outcome is a rigid and over-centralized urban-oriented administrative superstructure which, although purporting to serve the rural poor, lacks the necessary ability to reach out to them.

In attempting to meet the challenge, a few countries have undertaken commitments to the rural poor and given real priority to rural health care services. These include China, Cuba, Tanzania and Vietnam. Each system of primary health care differs in response to the varying needs and conditions of the community and country. There are some common characteristics, however, some of which would be of use in rural water

Photo: Brian Grover

Fetching water from a communal standpipe: water supply, sanitation and health care programs must be part of a single package if they are to be truly effective.

supply and sanitation programs. Primary health care activities may be centrally coordinated but they are locally controlled. Action takes place at the village level, the chief functionaries remain and work in the community, are responsible to it and preferably have been brought up there. Thus a source of education and information is always available to the village. Any technology introduced as part of the primary health care program can be maintained and is regarded as belonging to the community it serves.

Primary health care programs have been shown capable of reaching the village with basic environmental improvements. Unfortunately relatively few countries have thus far benefitted in this way. In other areas many low-cost health services projects are operating on a small scale and will serve as models on which national health care programs will be based. Few are engaged in improving excreta disposal and water supply and facilities as a result of lack of technical expertise, and thus confidence, in this area.

We are, I believe, at the beginning of a rapid expansion of rural health care programs. If they truly are, as they purport to be, "preventative" in orientation, then technical expertise in water and sanitation will have to be integrated into their activities and training programs. Conversely, if the poorest and remoter villagers are going to benefit from the coming surge of emphasis on water, we will have to look to the emerging primary health care programs as the most important mechanism of implementation.

If we are to speak of the importance of water supply, proper excreta disposal and hygiene, improvements to health and the need to implement such activities in rural areas of developing countries, they must be viewed together as components of a "sanitation package". If each component is left to be implemented separately, the potential health benefits are seriously constrained, if not totally lost.

The question is not how many water supplies can be installed over a given period of time, but why and how they are implemented, to what effect, and most important of all, at what opportunity costs? □

Dr McGarry is Associate Director, water supply and sanitation, with the Centre's Health Sciences Division.

WANTED: a better hand pump

David Henry

Any water supply system is only as good as its weakest component — and in rural areas of the Third World the weakest component is usually the pump. The reasons are simple: most hand pumps were designed long ago and far away for use in a completely different environment.

Over the past 100 years or so the basic design of the hand pump has remained virtually unchanged. What is badly needed is a better machine, and a group of scientists at the University of Waterloo, Canada, are hoping they may have it. With the support of an IDRC grant, the team at Waterloo — composed of senior members of the engineering faculty with backgrounds in physics, fluidics and chemical engineering — has been working on the problem since the beginning of the year. Their objective: "to optimize the design of a piston and check valve configuration for use in low-cost rural water pumps."

What they hope to produce is a pump that is reliable, tough, inexpensive, requires no specialized maintenance, and can be adapted to local manufacture. The exercise has focussed primarily on the use of various plastics, as opposed to traditional materials such as bronze, brass, cast iron, and mild steel. Plastic injection moulding techniques could result in considerable savings in manufacturing costs, and many developing countries already have the basic injection moulding capacity to produce pump components.

Given these guidelines, the researchers developed and tested a number of different design configurations in the laboratory. These prototypes are capable of being adapted to high, medium and low lift, and will be manufactured in four sizes, from 1½ to 3 inches diameter. This flexibility will allow the pumps to meet the wide variations in factors such as aquifer characteristics and population distribution that will be encountered in actual use.

The prototypes with the best performance record under laboratory conditions have now been selected for extensive field testing and research. Discussions are currently underway with five countries already engaged in pump development with a view to organizing a two-year testing program that will feed back into the design exercise the actual field experience. In this way further modifications can be incorporated if necessary.

One of the major parts of the field research will be to develop more effective driving mechanisms using local materials. The most common cause for breakdown of the traditional cast-iron pump is the rapid wear and tear at bearing points. The developing country researchers will study various types of woods as an inexpensive and easily replaceable alternative material for bearings.

The decision to investigate the applicability of local woods for bearing was based in part on the effectiveness of wooden bearings in machines such as bullock carts. Such carts in India, for example, run on wooden bearings, and carry more freight each day than the Indian railways! The researchers also discovered that in fact the North American petrochemical industry imports African hardwoods for use in the manufacture of high-stress bearings.

All field research teams will use a uniform guide for conducting pumping tests that will enable easy comparison of results. Progress reports will be prepared periodically during the two-year testing period, and disseminated as widely as possible. The one major question still to be dealt with is the most effective method of getting the new pump into the marketplace once the optimal design has been determined. That is something that will have to be decided during the next two years, and any suggestions will be welcomed.

David Henry is Assistant Director of the IDRC's Health Sciences Division.